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Process Resource Team

Evolving Postmortems as Teams Evolve Through TxP

November 2014

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Agenda

- NAVAIR

- Team Process Integration (TPI)

- Team "X" Process (TxP)

- Time-Based Postmortem

- Size-Based Postmortem

- Quality-Based Postmortem

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What is NAVAIR?

- NAVAIR is the **Naval Air Systems Command**

- Develop, acquire, and support the **aircraft** and related **weapons** systems used by **U.S. Navy and Marine Corps**

- Our **goal is to provide the fleet with quality products** that are both **affordable** and **available** when most **needed**

- Our support extends across the **entire life span** of a product, including all **upgrades and modifications** to that product

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Where is NAVAIR?

Lakehurst
ALRE - SUPPORT EQ
AIRCRAFT DIVISION

China Lake
WEAPONS
DIVISION

Patuxent River
NAVAIRHQ, PEOs
AIRCRAFT DIVISION

Pt Mugu
WEAPONS
DIVISION

**Cherry
Point**
NADEP DEPOT

NADEP DEPOT
**North
Island**
NATEC DEPOT

Jacksonville
NADEP DEPOT

Orlando
TRAINING
SYSTEMS
DIVISION

★ **NAVAIR Headquarters**

● **Acquisition/Test/Development Centers**

▲ **Naval Aviation Depots**

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Process Resource Team –
a PI History at NAVAIR

Process Improvement Phase

Year

Year	Event	Phase
2011	Change Management	**Team Process Based Systems+**
2010	Process Modeling	
2009		
2008		**Team Process Based Systems**
2007	TPI Launches	
2006		
2005	TPI Research	
2004		
2003	CMMI	**Model Based Systems**
2002		**Team Process Based Software**
2001	TSP Launches	
2000		
1999		
1998		**Personal Process Based Software**
1997	PSP classes	
1996		
1995		
1994		**Model Based Software**
1993	CMM	

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Team Process Integration (TPI)

# Models and Processes

Capability Maturity Models:
Reference for organizations building process capability

Team Processes:
Processes for teams
building quality products on cost and schedule

Personal Processes:
*Processes used to train individual skill and discipline*
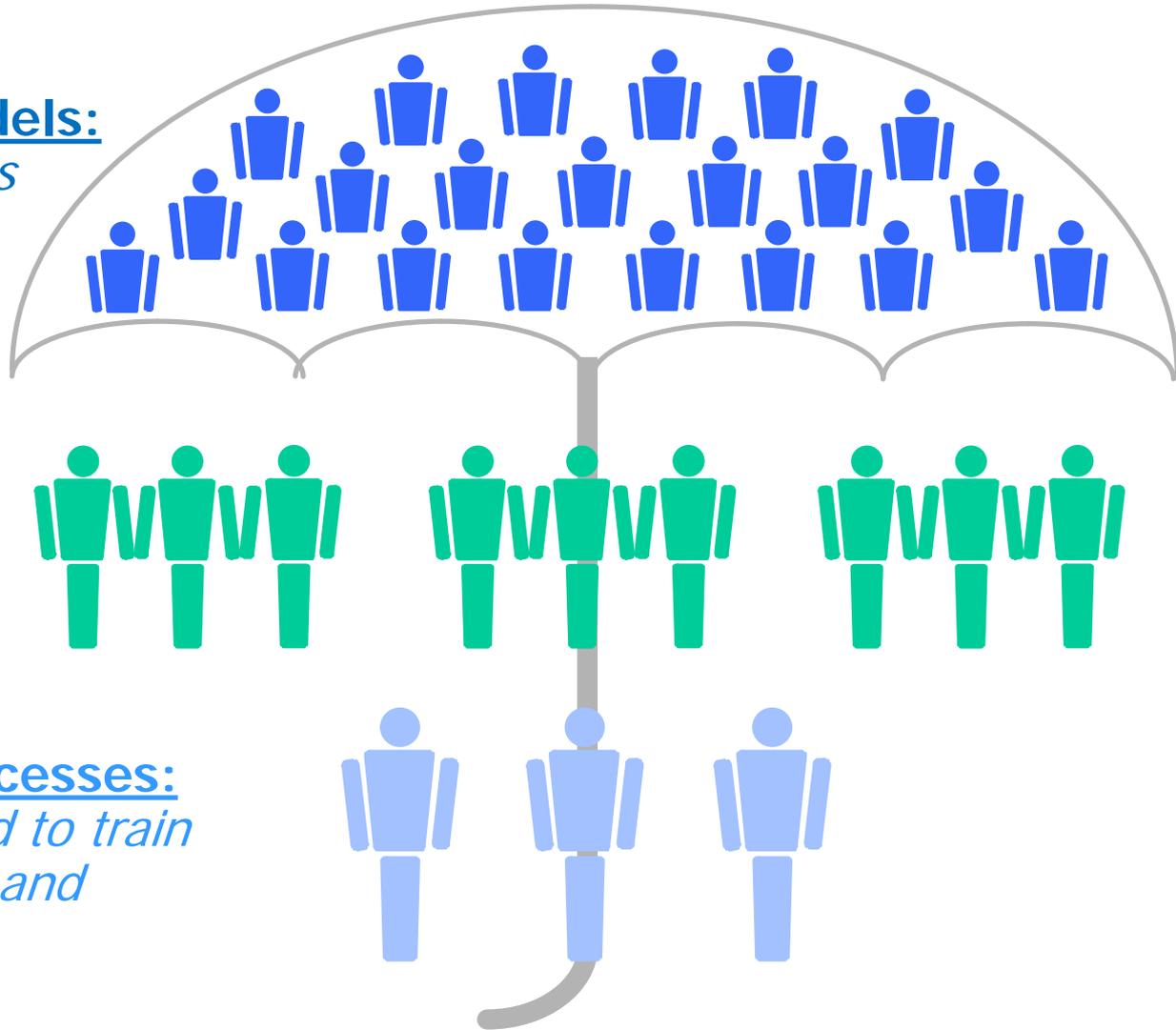
Key Team Process Framework

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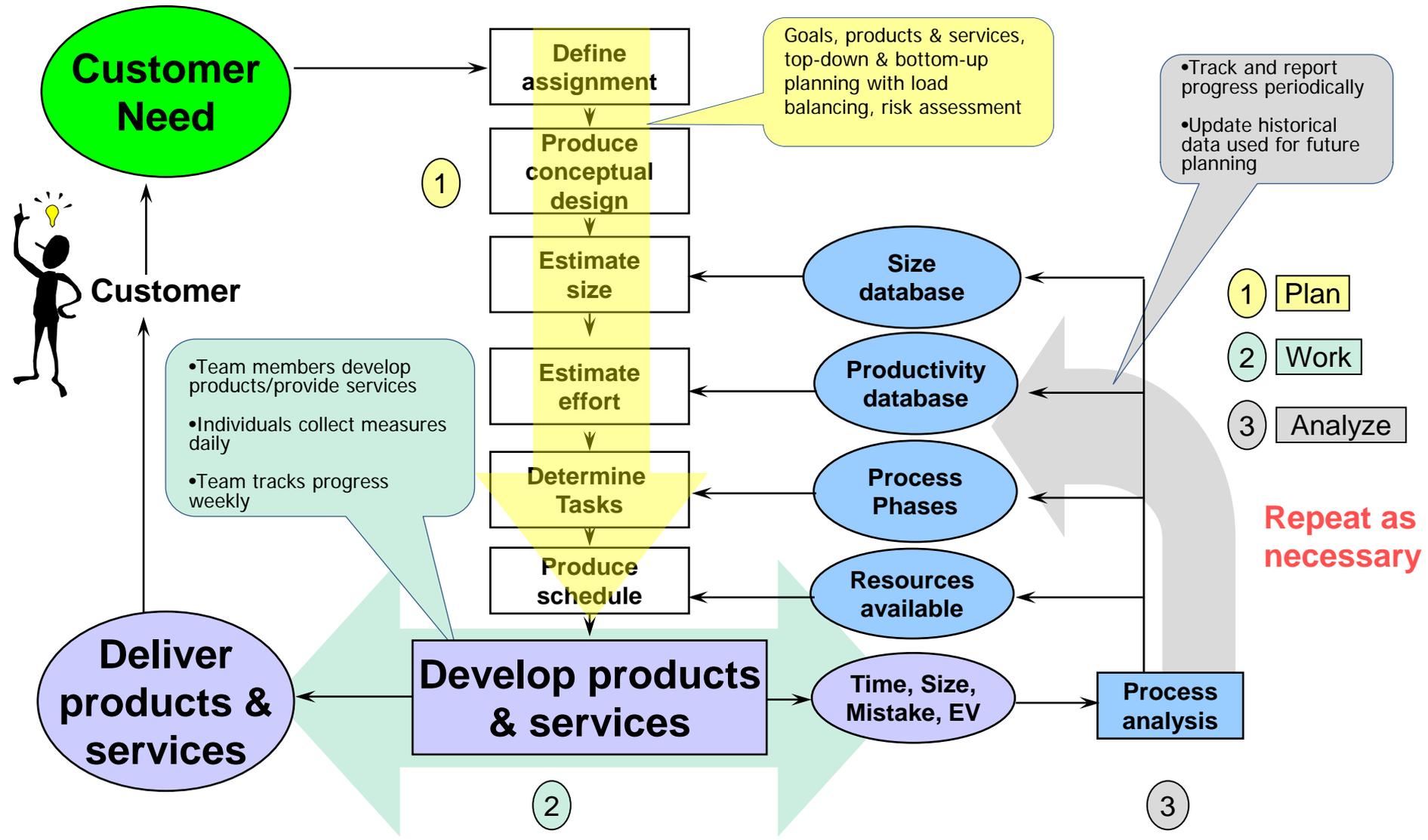
Team **Measures** and **Metrics**

- **Each team member gathers four basic measures**
  - **Times**
  - **Sizes**
 - **Mistakes**
  - **Task completion dates**

**Charts and tables of project metrics are available (updated in real time)**
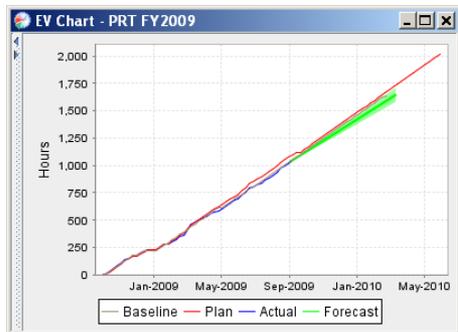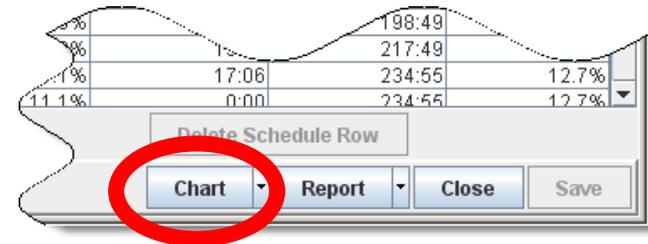
Direct Hours
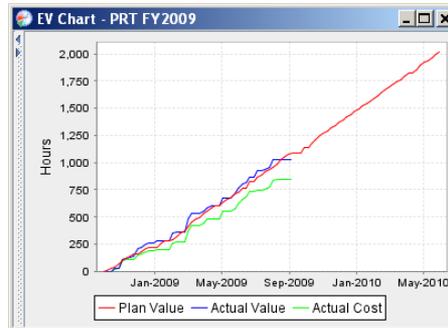
Earned Value
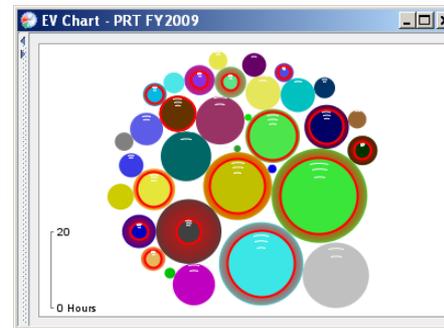
Tasks in Progress

many more…

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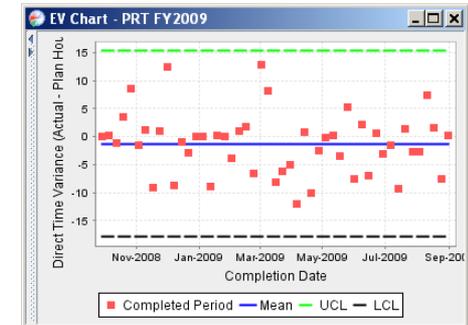
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NAVAIR TPI

- Success of software teams using TSP led their organizations to ask for same performance on other teams
  - Worked with the SEI to develop approach
  - Based on same TSP fundamental principles

- NAVAIR approach has become TPI for all teams
  - Teams plan all work from first launch forward
  - Work is based on all products and services defined in process modeling
  - PSP for Engineers training planned as part of project if appropriate

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Just-in-Time TPI Training

Learning

Doing

Personal Process
(half-day)

Process Modeling
(one to four half-day sessions)

Personal Planning
Personal Quality
Plan Overview
(half-day)

Plan the work
(four days)

Operational Overview
TPI Tool Overview
(half-day)

Work the plan
(cycle 1)
(three to nine months)

PSP Fundamentals
(one week)

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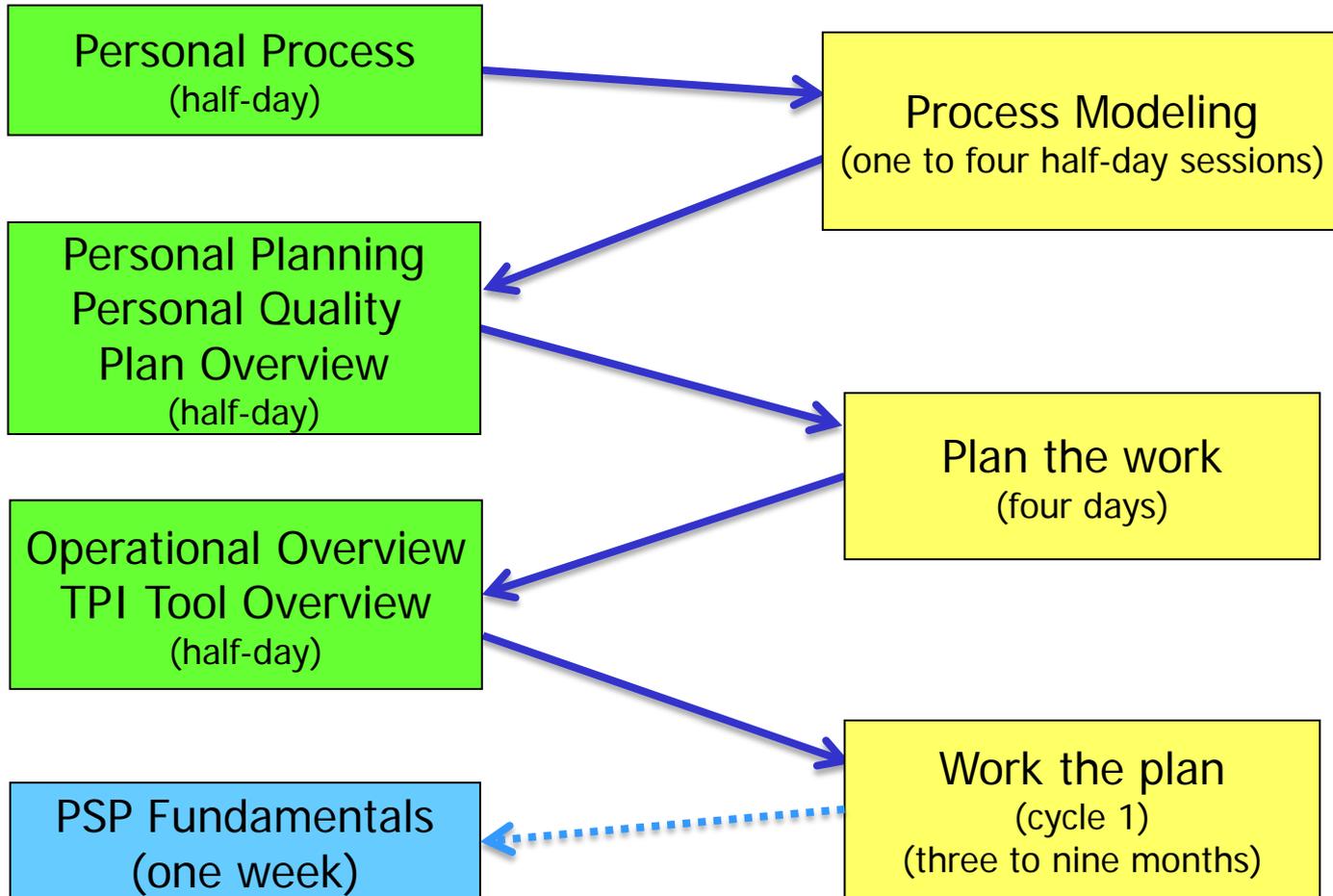
Team [topic-name] Process (TxP)

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TPI **Pluses** & **Minuses**

+ A detailed plan!

+ Ability to track progress (weekly)

+ Improved estimating (over cycles)

– No mature processes
  – "Where do we put mistake-fixing phases?"

– No defect type standards
  – "What kinds of mistakes do I make?"

– No quality planning
  – "Will our plan produce a good product?"
  – No quality indicators (e.g., A/FR)

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???

TRP
(Rqmts)

ds
ucts
d

T **TTP**
(S/W) (Sys Test)

TxP

PRP

ds
kill
*ne*

P **PTP** ... **PxP**

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TPI is Only a Waypoint

- TPI teams will hit a glass ceiling

- TPI teams need to evolve to achieve TSP-like performance (become a TxP team)

- What else does a TPI team have to do in order to become a TxP team?

- *What does a TSP team do?*

What Does a TSP Team Do?

(Plan the Work)   **(Work the Plan)**   **(Analyze the Data)**

Launch	Weekly Meetings and Day-to-Day Actions	Postmortem

Typical TSP Cycle

Time →

TSP Activities

Working Activities

Planning Activities

Analyzing Activities

And they develop software too!

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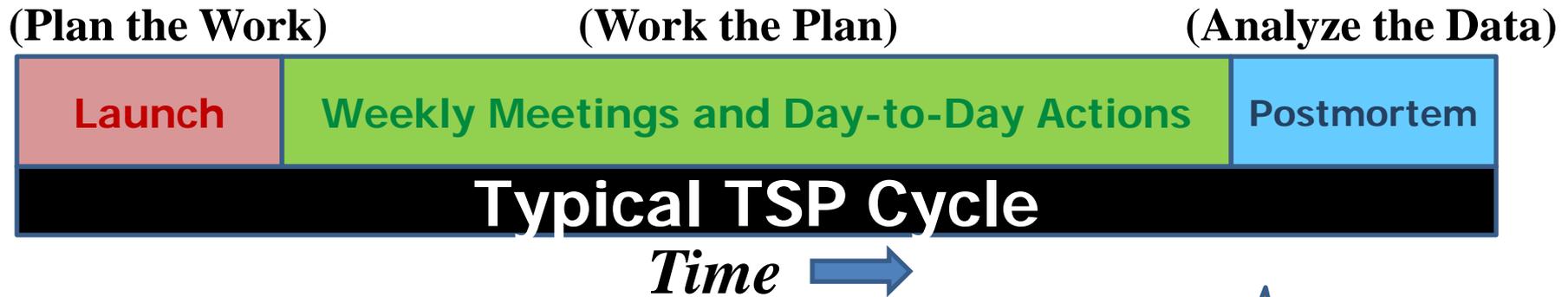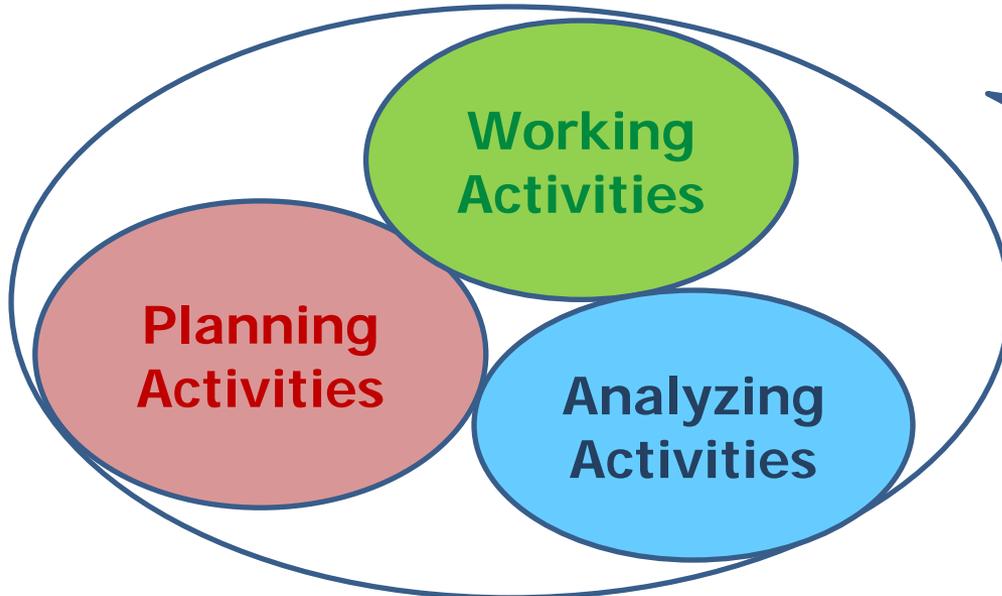
TxP Planning Activities

	From The Start	Some Time Later	Get To Last
Project and Management Objectives	✓		
Team Goals and Roles	✓		
Project Strategy and Support	✓		
Overall Plan	✓		
Planned sizes and rates used to compute times		✓	
Quality Preparation	✓		
Planned Defects Injected/Removed			✓
Planned quality indicator values are acceptable			✓
Balanced Plan	✓		
Project Risk Analysis	✓		
Launch Report Preparation	✓		
Management Review	✓		
Launch Postmortem	✓		

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TxP Working Activities

	From The Start	Some Time Later	Get To Last
Logging time	✔		
Logging defects	✔		
Tracking EV	✔		
Using PROBE in Planning phase		✔	
Entering actual sizes in Postmortem phase		✔	
Defining Defect Types			✔
Using Review checklists			✔
Holding periodic team meetings	✔		
Following an agenda during team meetings	✔		
Performing/reporting on assigned roles	✔		
Reviewing action items	✔		
Reviewing assigned goals and risks	✔		
Maintaining project plan and workbook	✔		

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TxP Analyzing Activities

	From The Start	Some Time Later	Get To Last
Evaluate plan vs. actual schedule hours	✓		
Evaluate plan vs. actual component hours	✓		
Evaluate plan vs. actual component sizes		✓	
Evaluate team performance vs. goals and quality plan			✓
Evaluate plan vs. actual quality of components			✓
Update planning data for schedule hours	✓		
Update planning data for lifecycle time-in-phase %s	✓		
Update planning data for productivity rates		✓	
Update planning data for defect densities		✓	
Update planning data for defect rates and yields		✓	
Update planning data for quality indicator thresholds			✓

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Transitions

Training & First Launch	Product Size Definition	Defect Removal	Quality Indicators
✓3-part TPI Training	✓Define size measures	✓Define Defect Types	✓Define Product Quality Indicators
✓Process Modeling	✓Add Planning and Postmortem phases	✓Refine Processes with Defect Removal Phases	✓Define Process Quality Indicators
✓First Launch	✓Begin use of PROBE		

Stages → TIME-Based → SIZE-Based → QUALITY-Based → **TxP**

Planning Activities

Working Activities

Analyzing Activities

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Time-Based Postmortem

- The team's most consistent data at first is time
  - Time on Task by Team Member
  - Planned vs. Actual Time by Component
  - Planned vs. Actual Time by Product/Service Type
  - Planned vs. Actual Time by Workflow
- Sample Time Log

| Logged To	Start Time	Delta
/Project/PRT FY2014/Common/Monthlies/Oct 2013/TPI Coaching/AV-8B SW/Do	Tue Oct 08 08:00:52 PDT 2013	0:10
/Project/PRT FY2014/TPI/Checkpoints/H-1 SIT - Aug 2013 part 2/Follow-up	Tue Oct 08 08:20:49 PDT 2013	0:17
/Project/PRT FY2014/TPI/Checkpoints/H-1 SIT - Aug 2013 part 2/Follow-up	Tue Oct 08 08:45:47 PDT 2013	0:05
/Project/PRT FY2014/TPI/Checkpoints/H-1 SIT - Aug 2013 part 2/Follow-up	Tue Oct 08 09:08:18 PDT 2013	0:21
/Project/PRT FY2014/TPI/Checkpoints/H-1 SIT - Aug 2013 part 2/Follow-up	Tue Oct 08 10:00:13 PDT 2013	0:05
/Project/PRT FY2014/Common/Monthlies/Oct 2013/TPI Coaching/Informal/Do	Tue Oct 08 10:17:40 PDT 2013	0:10
/Project/PRT FY2014/TPI/Checkpoints/H-1 SIT - Aug 2013 part 2/Follow-up	Tue Oct 08 10:29:44 PDT 2013	0:10
/Project/PRT FY2014/TPI/Checkpoints/H-1 SIT - Aug 2013 part 2/Follow-up	Tue Oct 08 10:54:50 PDT 2013	0:07
/Project/PRT FY2014/TPI/Checkpoints/H-1 SIT - Aug 2013 part 2/Follow-up	Tue Oct 08 11:23:09 PDT 2013	0:12
/Project/PRT FY2014/Common/Monthlies/Oct 2013/TPI Coaching/AV-8B SW/Do	Tue Oct 08 13:53:34 PDT 2013	0:07
/Project/PRT FY2014/Common/Monthlies/Oct 2013/TPI Coaching/CEI SSAT/Do	Tue Oct 08 14:01:02 PDT 2013	2:16
/Project/PRT FY2014/Common/Monthlies/Oct 2013/TPI Coaching/CEI SSAT/Do	Tue Oct 08 16:59:59 PDT 2013	0:33
/Project/PRT FY2014/Common/Monthlies/Oct 2013/TPI Coaching/CEI SSAT/Do	Tue Oct 08 17:44:18 PDT 2013	0:42
/Project/PRT FY2014/Common/Monthlies/Oct 2013/TPI Coaching/H-1 SIT/Do	Wed Oct 09 06:35:14 PDT 2013	0:11
/Project/PRT FY2014/Common/Monthlies/Oct 2013/TPI Coaching/H-1 SIT/Do	Wed Oct 09 07:20:14 PDT 2013	0:21
/Project/PRT FY2014/Common/Monthlies/Oct 2013/TPI Coaching/CCS/Do	Wed Oct 09 08:00:06 PDT 2013	0:48

Planned vs. Actual Time by Week
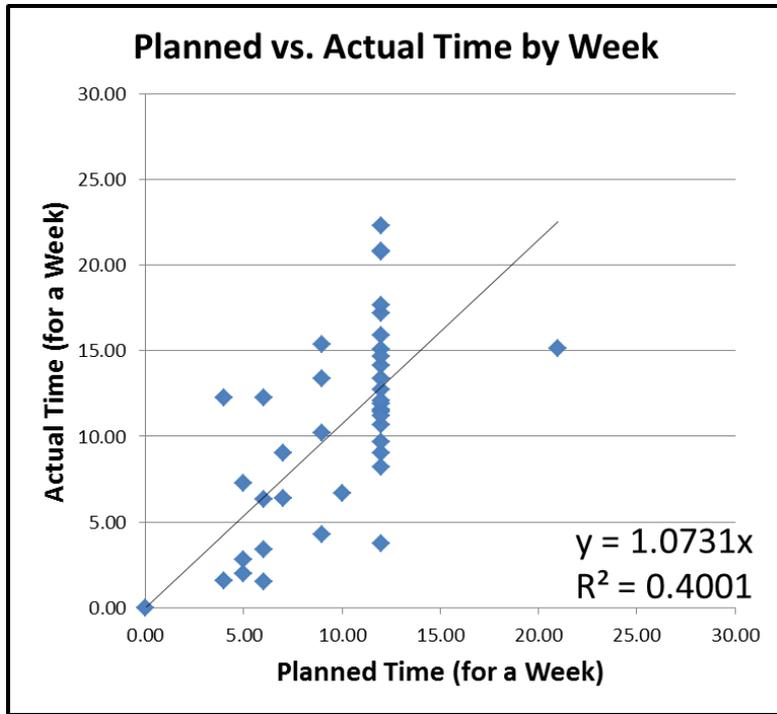
Planned Time	Count	Avg Actual Time	% of PT
0	1	0.0	
1	0		
2	0		
3	0		
4	2	6.9	173%
5	3	4.0	80%
6	4	5.9	98%
7	2	7.7	110%
8	0		
9	4	10.8	120%
10	1	6.7	67%
11	0		
12	21	13.5	113%
13	0		
14	0		
15	0		
16	0		
17	0		
18	0		
19	0		
20	0		
21	1	15.2	72%
22	0		

$y = 1.0731x$

$R^2 = 0.4001$

% of Time Entries Ending in
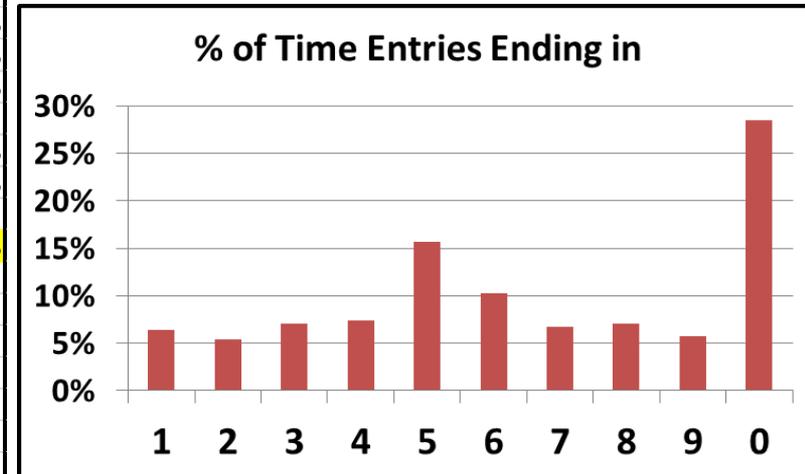
% of entries across all numbers	70%
extra on 5s and 0s	30%

- Time Log analysis
  - Accuracy & precision of estimates
  - Real-time logging vs. backfilling

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Time by Component

By Component

$y = 0.5018x$
$R^2 = 0.4022$

By Component Type

+18%
-3%
+29%
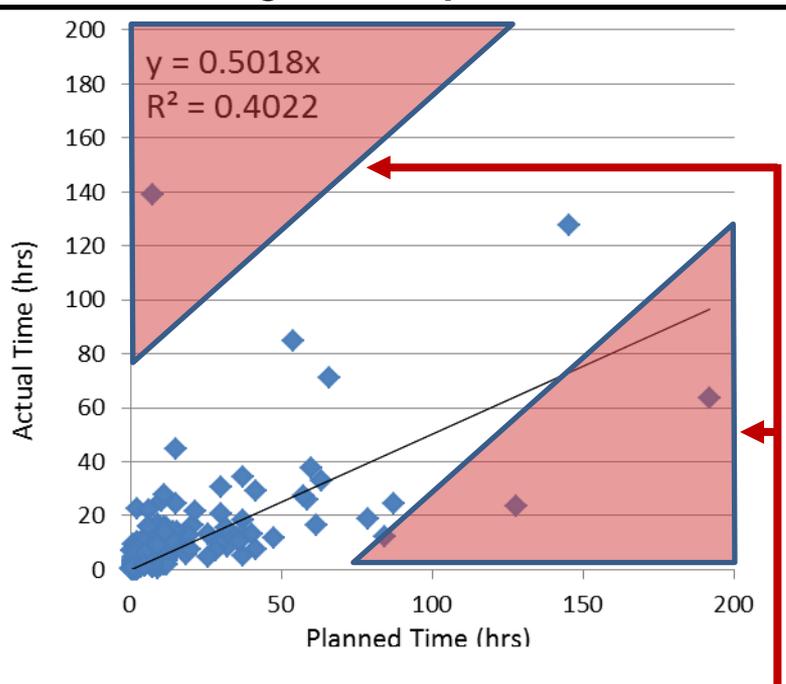
Planned Time   Actual time
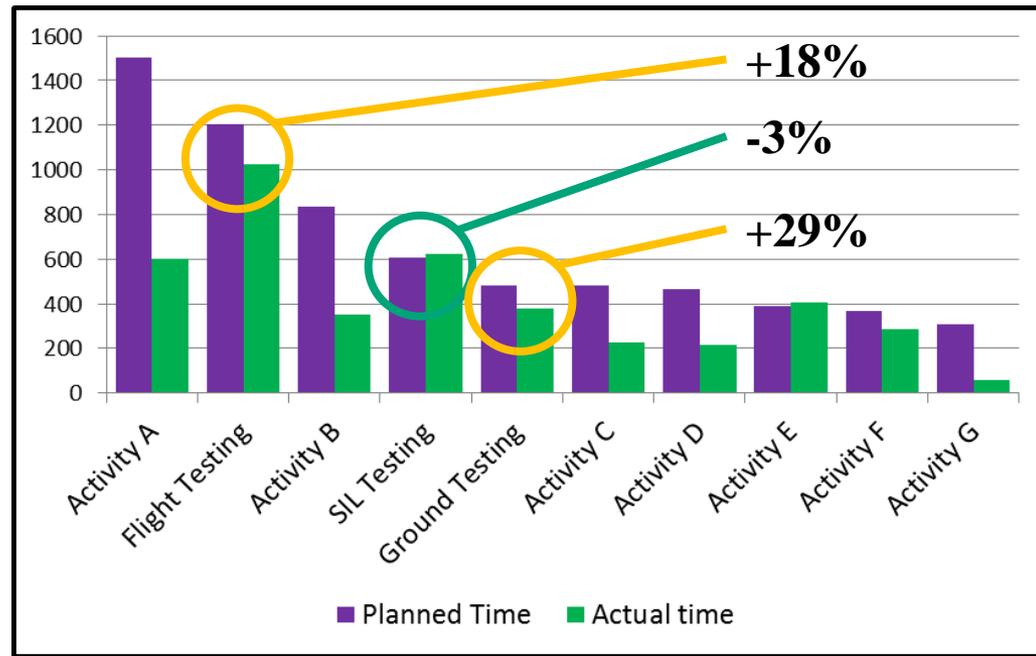
- Study any points in red regions
- Adjust team productivity rates for next cycle

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Time by Workflow

	Plan Time	Actual Time	Plan %	Actual %	Act - Plan	Next Plan	Normalized
Planning	68:06	41:03	2.4%	1.4%	-1.1%	2.4%	**2.3%**
High-Level Design	248:01	251:46	8.8%	8.4%	-0.4%	8.8%	**8.4%**
HLD Inspection	103:07	65:44	3.7%	2.2%	-1.5%	3.7%	**3.5%**
Detailed Design	356:52	339:32	12.7%	11.3%	-1.4%	12.7%	**12.2%**
Detailed Design Review	129:06	90:59	4.6%	3.0%	-1.6%	4.6%	**4.4%**
Test Development	61:44	34:58	2.2%	1.2%	-1.0%	2.2%	**2.1%**
Detailed Design Inspection	294:44	220:51	10.5%	7.4%	-3.1%	7.4%	**7.1%**
Code	435:48	575:10	15.5%	19.2%	3.7%	19.2%	**18.4%**
Code Review	143:08	112:39	5.1%	3.8%	-1.3%	5.1%	**4.9%**
Compile	21:04	16:06	0.7%	0.5%	-0.2%	0.7%	**0.7%**
Unit Test	349:58	485:12	12.4%	16.2%	3.7%	16.2%	**15.5%**
Code Inspection	365:50	444:37	13.0%	14.8%	1.8%	13.0%	**12.5%**
Build and Integration Test	189:47	290:05	6.7%	9.7%	2.9%	6.7%	**6.5%**
Postmortem	46:48	29:26	1.7%	1.0%	-0.7%	1.7%	**1.6%**
Total	2814:03	2998:08	100.0%	100.0%		104.3%	100.0%

- ## Isolate times for one kind of activity
  - Analyze & discuss big differences
  - Proposed planned %s for next cycle

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Size-Based Postmortem

- Once the team has consistent size data…
  - Productivity Rates by Team Member
  - Planned vs. Actual Size by Component
- Example of Size Documentation

BASE PROGRAM SIZE	Estimated SIZE	Actual SIZE
BASE SIZE (B)	150	150
DELETED SIZE (D)	75	75
MODIFIED SIZE (M)	8	8

BASE ADDITIONS	Estimated				Actual	
	TYPE	ITEMS	REL. SIZE	SIZE	SIZE	ITEMS
Report Altitude				10	13	
add more rows for base additions…			Total:	10	13	

PARTS ADDITIONS	Estimated					Actual		
	TYPE	ITEMS	REL. SIZE	SIZE	NR	SIZE	ITEMS	NR
GUI	I/O	1	Medium	16		22		
Altimeter Referencing	Logic	1	Large	23		33		
add more rows for parts additions…			Total:	39		55		

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Productivity Rates by Team Member

- All individuals have their own rates…per product type

	Beta1 (minutes/LOC) =	1.587
	PSP Productivity Rate (LOCs/Hr) =	38
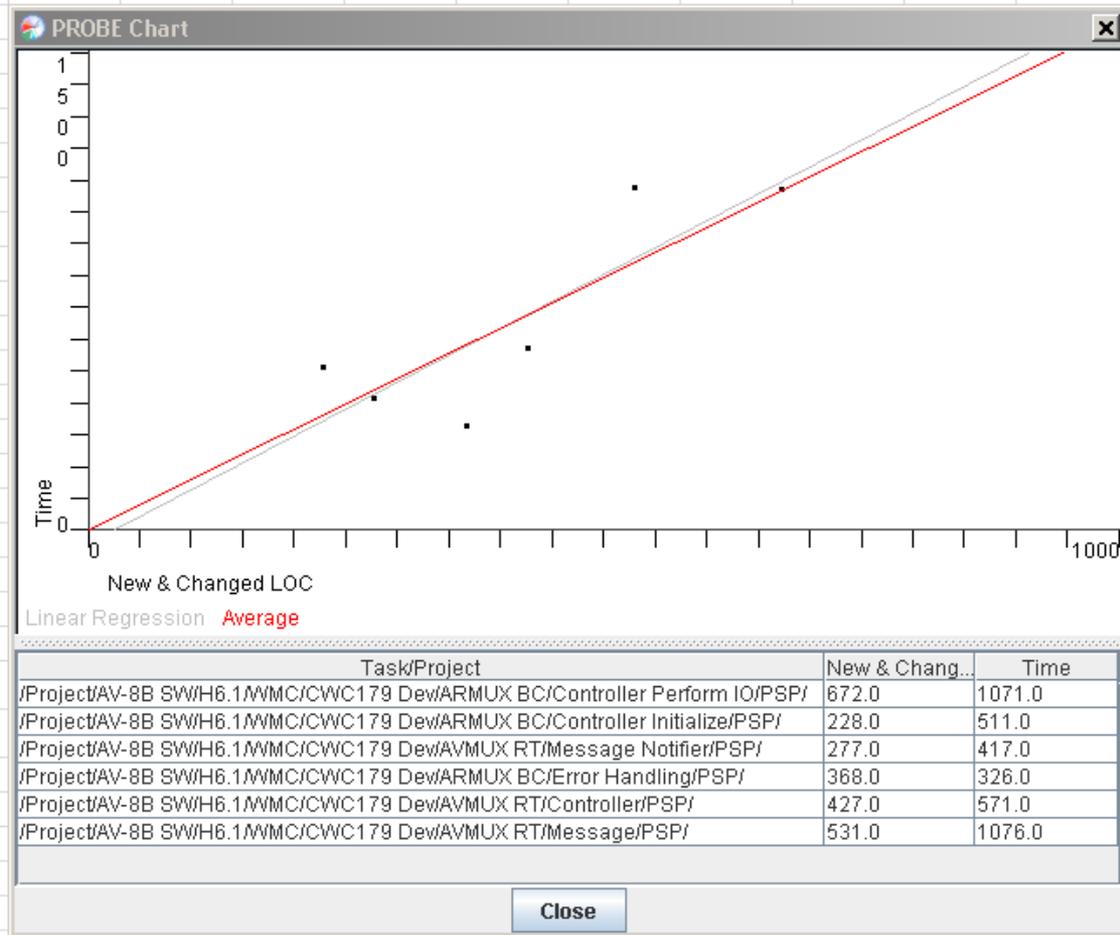
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Size by Component

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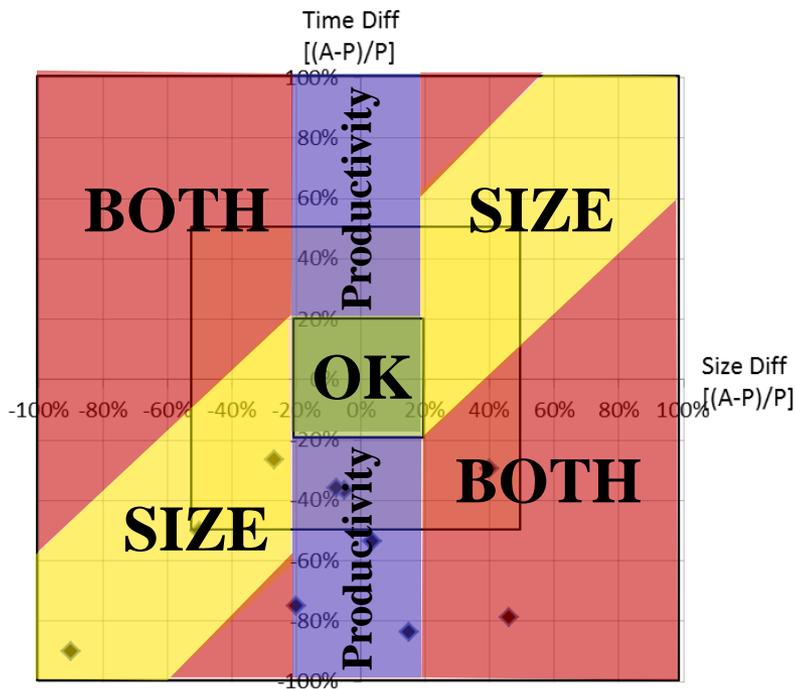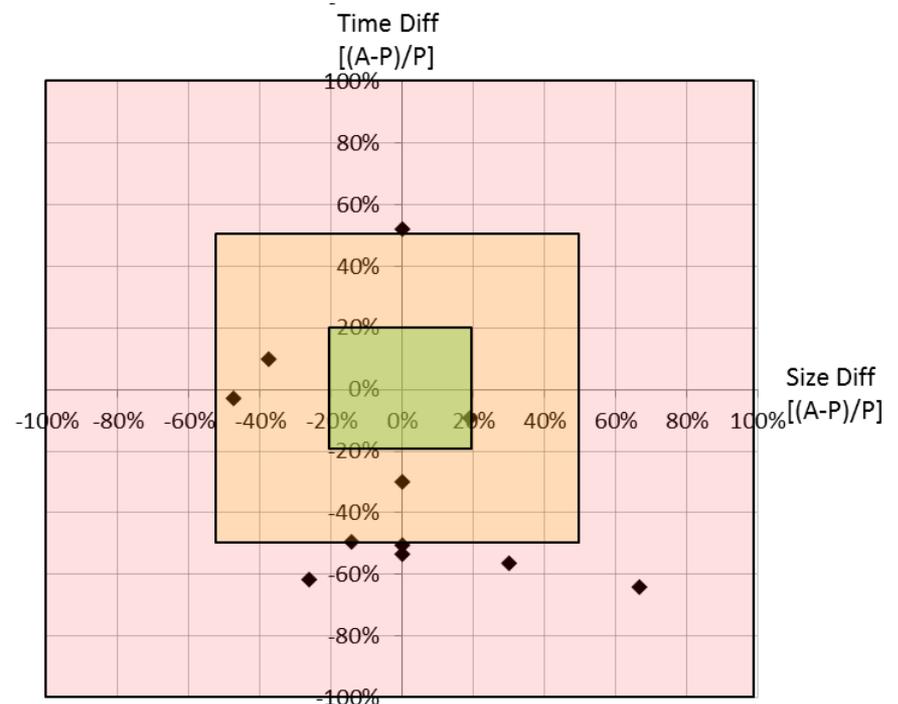
Quality-Based Postmortem

- Getting a handle on defects usually happens last
  - Defect Injection Rate by Phase
  - Defect Measures by Defect Type
  - Defects Injected by Phase
  - Defects Removed by Phase

- Sample Defect Log

Project	ID	Type	Injected	Removed	Time	Count	...	...	Description	Date
/Non Project/PSP for Engineers/Program 5	1	Environment	Test	Test	0.6	1			did not configure wires properly during board test	09/03/2009
/Non Project/dev/PMPT/JDAM Cross Range	1	Interface	Design	Design Review	5.3	1			forgot to consider general architecture classes in my ...	08/25/2010
/Non Project/dev/PMPT/JDAM Cross Range	2	Assignment	Design	Design Review	10.8	15			didn't initialize parameters	09/10/2010
/Non Project/dev/PMPT/JDAM Cross Range	3	Documentation	Design	Design Review	5	1			did not draw data flow arrows in correct direction bet...	10/13/2010
/Non Project/dev/PMPT/JDAM Cross Range	4	Interface	Design	Design Review	0.6	1			forgot to flesh out paras for func Compute Angle	11/17/2010
/Non Project/dev/PMPT/JDAM Cross Range	5	Interface	Design	Design Review	1.2	1			forgot to flesh out paras for func Compute Range	11/18/2010
/Non Project/sw history/Prod A Reqt 3	1	Function	Code	Test	1.1	1			inverted to variables	01/28/2009
/Non Project/sw history/Prod A Reqt 3	2	Unclear	Design	Design Review	0.9	3			did not give vars initial values...	10/11/2011

Defect Injection Rate by Phase

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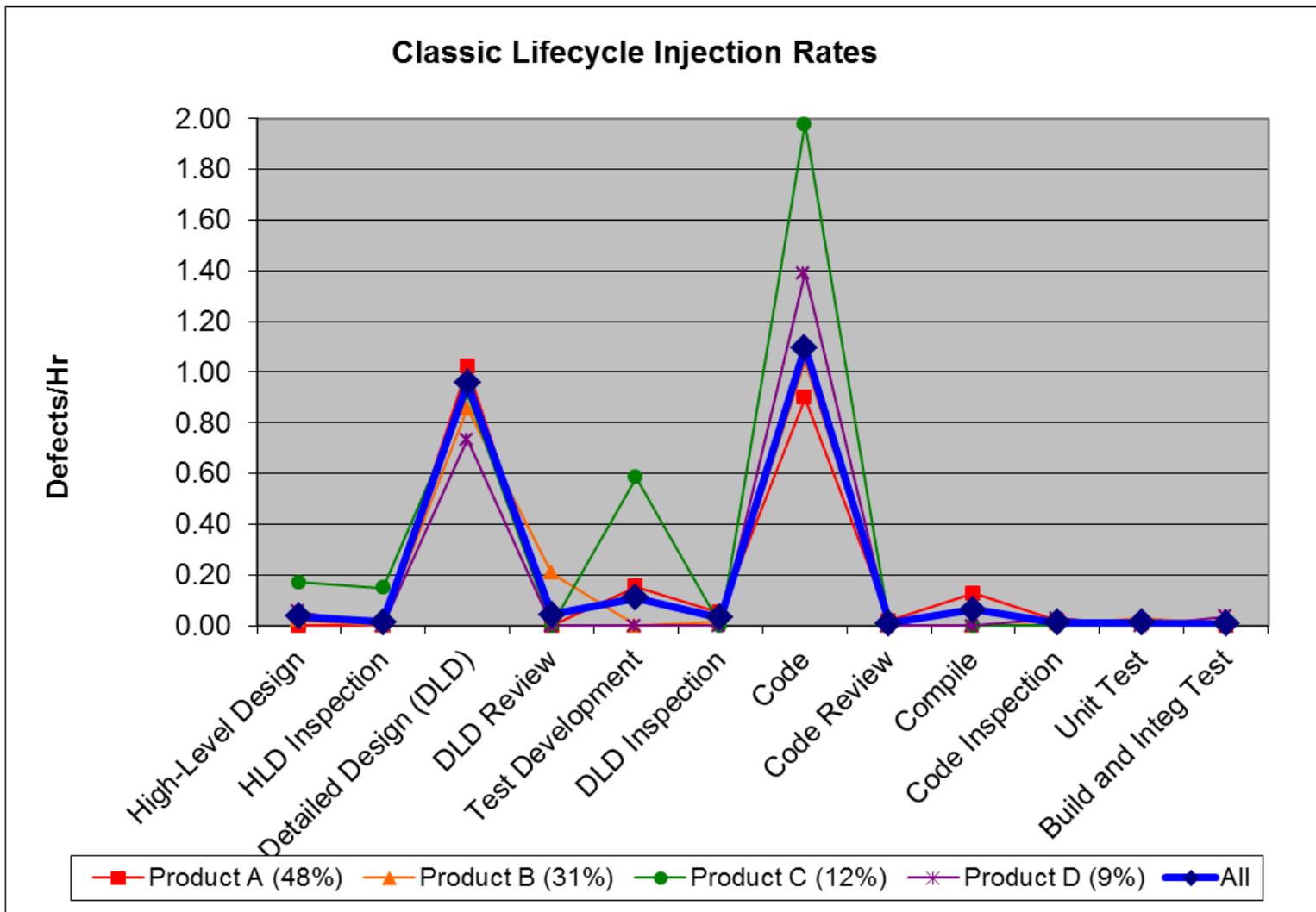
Defect Measures by Defect Type

Defect Fix Times
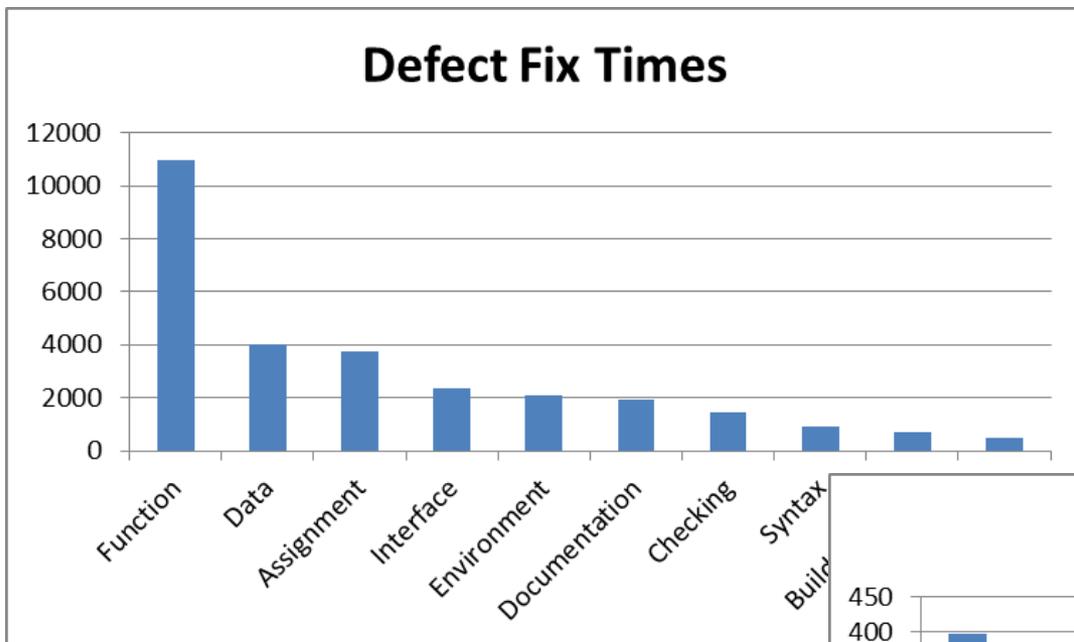
How many doesn't always matter

Defect Counts

- Sorted by Fix Time

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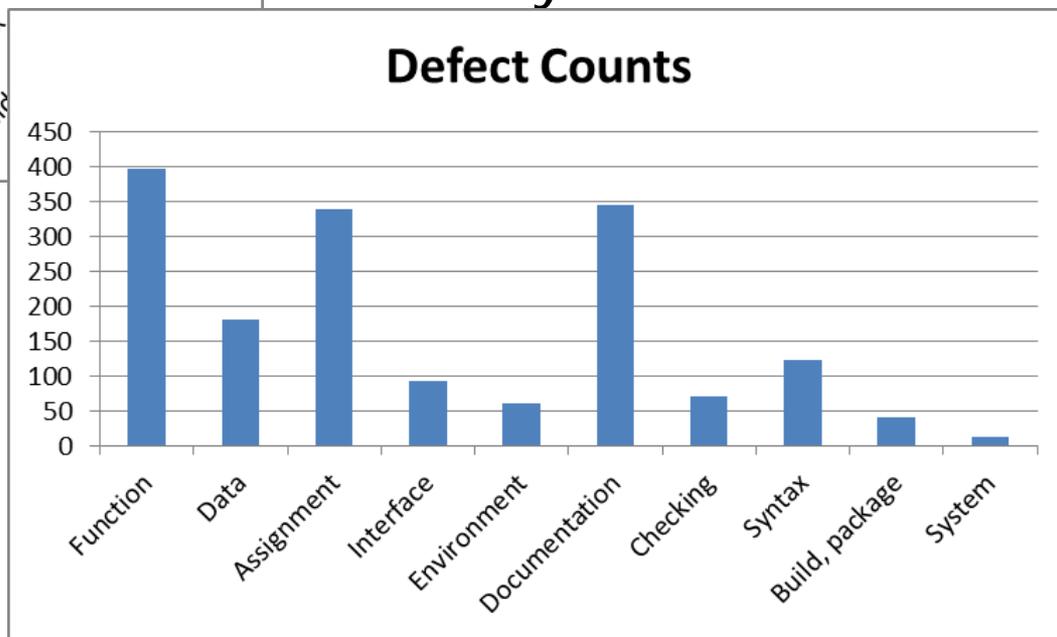
Defects Injected/Removed by Phase

Planned vs. Actual Phase Yields
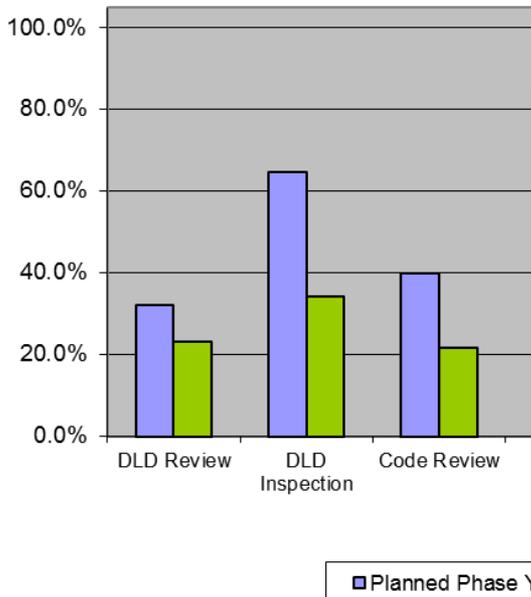
Cumulative Defects Injected and Removed

<200 remaining

>600 remaining

Legend: Cum Actual Injected | Cum Removed (70%) | Cum Removed (50%) | Cum Actual Removed

Height of Red above Green indicates how many mistakes were in the product at that phase of development

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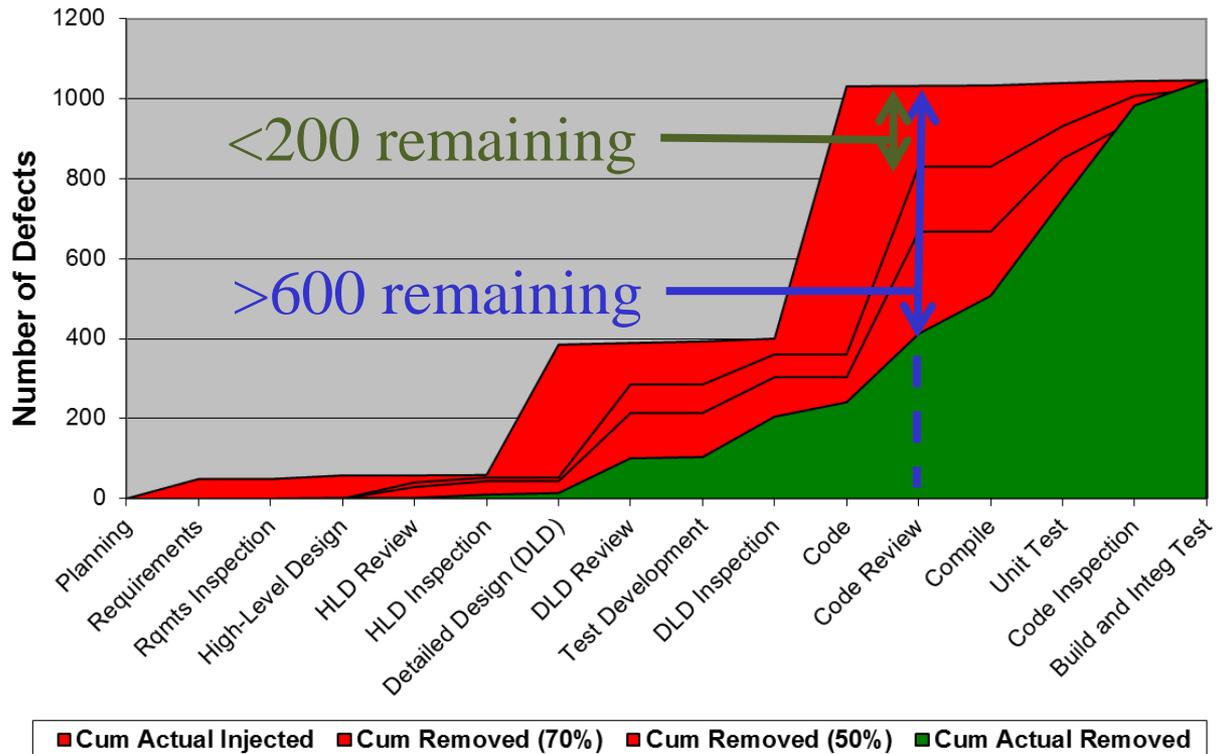
TxP Postmortem

- Only after the team knows what level of process performance results in a quality product, then they can set goals and compare planned values to actual values.

RATIOS				
Plan	**Actual**	**Phase**		
0.36	0.27	DLD Review/DLD Ratio		
0.82	0.59	DLD/Code ratio		
0.33	0.20	Code Review/Code		
0.00	3.15	Compile Defect Density		
8.86	7.81	Unit Test Defect Density		

REVIEW RATES (LOCs/hr)				
Plan	**Actual**	**Phase**		
336	829	DLD review		
71	136	DLD inspection		
147	266	CODE review		
60	62	CODE inspection		

Cost of Quality (COQ)		
Topic	**Plan**	**Actual**
% Appraisal COQ	36.8%	30.8%
% Failure COQ	19.9%	26.1%
Appraisal / Failure Ratio (AFR)	1.85	1.18

Things to Remember

- As a team's process evolves from TPI to TxP, the analysis of their data needs to evolve too

- Focus on what is value-added to the team and they will strive to collect the data

- This analysis gives them insight into the quality of their processes used to produce their products and provide their services

Questions?

NAVAIR Process Resource Team

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  - Capability Maturity Model Integration$^{®}$
  - CMMI$^{®}$
  - CERT$^{®}$

Acronym List

- A/FR – Appraisal Failure Ratio
- CMM – Capability Maturity Model
- CMMI – Capability Maturity Model Integration
- COQ – Cost of Quality
- DLD – Detailed-Level Design
- EV – Earned Value
- HLD – High-Level Design
- LOC – Line of Code
- NAVAIR - Naval Air Systems Command
- PI – Process Improvement
- PROBE – PROxy-Based Estimating
- PRT – Process Resource Team
- PSP – Personal Software Process
- SEI – Software Engineering Institute
- TSP – Team Software Process
- TPI – Team Process Integration
- TxP – Team [topic name] Process

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